






An Analysis of Water Usage & Conservation in Non-Functional Turf areas for Davis County Government Facilities.

By: Austin Storey

Irrigation Systems

8 Series MPR					
10° Trajectory					
Nozzle	Pressure psi	Radius ft.	Flow gpm	Precip In/h	Precip In/h
8F 	15	5	0.74	2.85	3.29
	20	6	0.86	2.30	2.66
	25	7	0.96	1.89	2.18
	30	8	1.05	1.58	1.82
8H 	15	5	0.37	2.85	3.29
	20	6	0.42	2.25	2.59
	25	7	0.47	1.85	2.13
	30	8	0.52	1.56	1.81
8Q 	15	5	0.18	2.77	3.20
	20	6	0.21	2.25	2.59
	25	7	0.24	1.89	2.18
	30	8	0.26	1.56	1.81
Note: All MPR nozzles tested on 4" (10.2 cm) pop-ups  Square spacing based on 50% diameter of throw  Triangular spacing based on 50% diameter of throw					









12 Series MPR					
30° Trajectory					
Nozzle	Pressure psi	Radius ft.	Flow gpm	Precip In/h	Precip In/h
12F 	15	9	1.80	2.14	2.47
	20	10	2.10	2.02	2.34
	25	11	2.40	1.91	2.21
	30	12	2.60	1.74	2.01
12H 	15	9	0.90	2.14	2.47
	20	10	1.05	2.02	2.34
	25	11	1.20	1.91	2.21
	30	12	1.30	1.74	2.01
12Q 	15	9	0.45	2.14	2.47
	20	10	0.53	2.02	2.34
	25	11	0.60	1.91	2.21
	30	12	0.65	1.74	2.01
Note: All MPR nozzles tested on 4" (10.2 cm) pop-ups  Square spacing based on 50% diameter of throw  Triangular spacing based on 50% diameter of throw					

Figure 1: (rainbird.com, 2021)

Irrigation Systems



15 Series MPR					
30° Trajectory					
Nozzle	Pressure psi	Radius ft.	Flow gpm	Precip In/h	Precip In/h
15F 	15	11	2.60	2.07	2.39
	20	12	3.00	2.01	2.32
	25	14	3.30	1.62	1.87
	30	15	3.70	1.58	1.83
15H 	15	11	1.30	2.07	2.39
	20	12	1.50	2.01	2.32
	25	14	1.65	1.62	1.87
	30	15	1.85	1.58	1.83
15Q 	15	11	0.65	2.07	2.39
	20	12	0.75	2.01	2.32
	25	14	0.82	1.62	1.87
	30	15	0.92	1.58	1.83



Note: All MPR nozzles tested on 4" (10.2 cm) pop-ups
 Square spacing based on 50% diameter of throw
 Triangular spacing based on 50% diameter of throw

Figure 2: (rainbird.com, 2021)

Davis County Administration Building



Davis County Administration Building

- 2,965 sq. ft.
- 133 sprinklers
- MPR 8 Series 180° = .52 gal/per min
- $133 \times 0.52 = 69.16$ gal/ per min
- 69.16×30 minutes = 2,074.8 gallons per cycle
- $2,074.8$ gallons $\times 3$ cycles per week = 6,224.4 gallons per week
- 24 weeks of irrigation per summer = **149,385.60 gallons of water.**
- **Plausible water needs for new design = 96,540 gallons**
- **Plausible Net Water Savings = 56,845.6 gallons**
- **Plausible Renovation Costs: \$19,272.50**

Health Department



Health Department

- Total square footage of turf being irrigated = 10,478 sq. ft.
- 298-MPR 8 Series 180° @ 0.52/gal per min.
- 15-MPR 15 Series 360° @ 3.70/gal per min.
- 24 weeks of irrigation per summer = **454,593.60 gallons of water.**
- **Plausible water needs for new design = 211,130 gallons**
- **Plausible Net Water Savings = 243,463.6 gallons**
- **Plausible Renovation Costs: \$68,107.00**

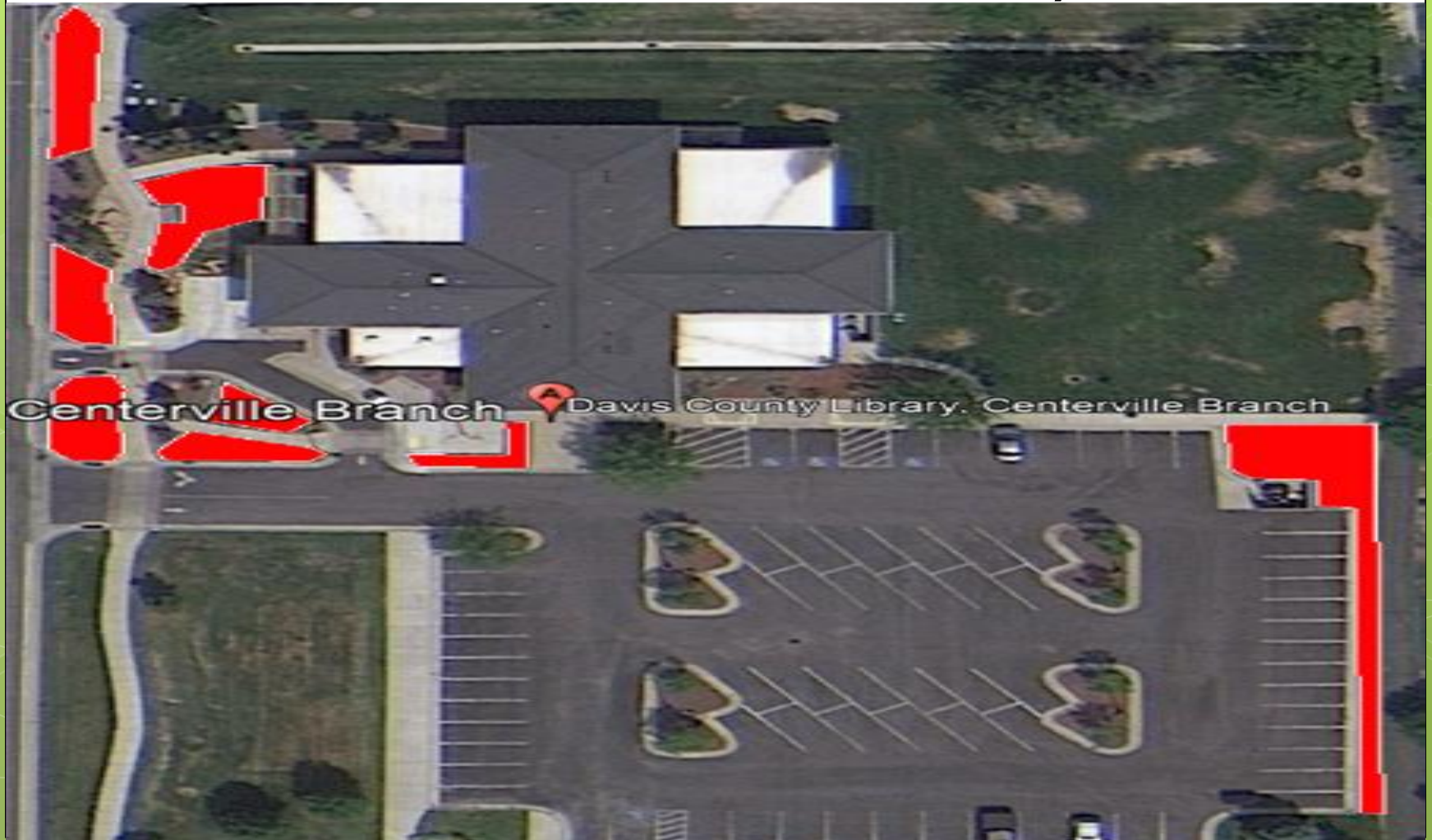
Layton Library



Layton Library

- Total square footage of turf = 11,888.5 sq. ft.
- 215-MPR 8 Series 180° @ 0.52 gal/per min.
- 104-MPR 15 Series 360° @ 3.70 gal/per min
- 24 weeks of irrigation per summer = **1,072,656 gallons of water.**
- **Plausible water needs for new design = 274,280 gallons**
- **Plausible Net Water Savings = 798,376 gallons**
- **Plausible Renovation Costs: \$77,275.25**

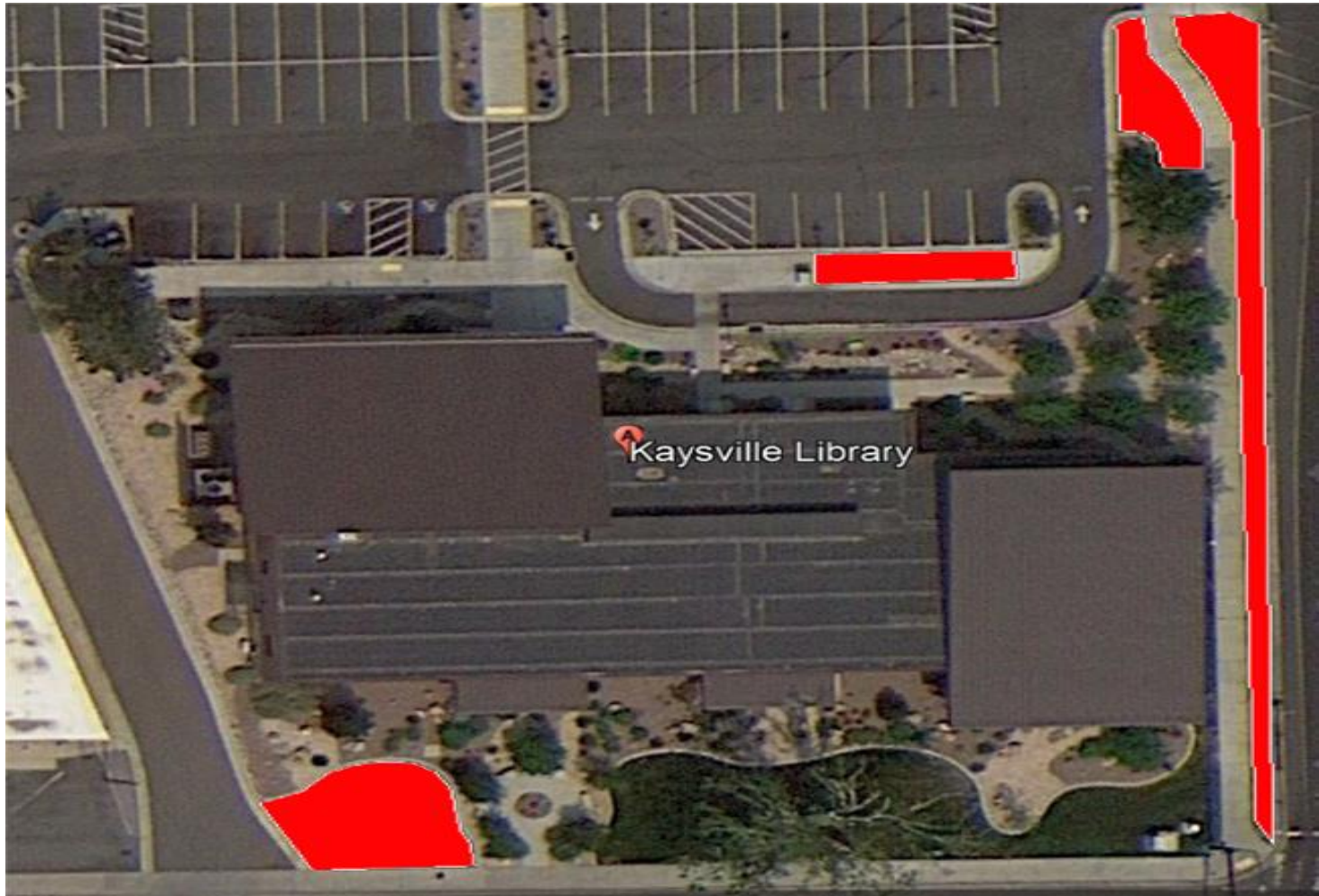
Centerville Library



Centerville Library

- Total square footage of turf = 3,918 sq. ft.
- 152-MPR 8 Series sprinklers @ 0.52 gal/per min
- $7,113.6 \times 24 \text{ weeks} = \underline{\underline{170,726.4}}$ gallons used per summer.
- Plausible water needs for new design = 96,540 gallons
- Plausible Net Water Savings = 74,186.4 gallons
- Plausible Renovation Costs: \$25,467.00

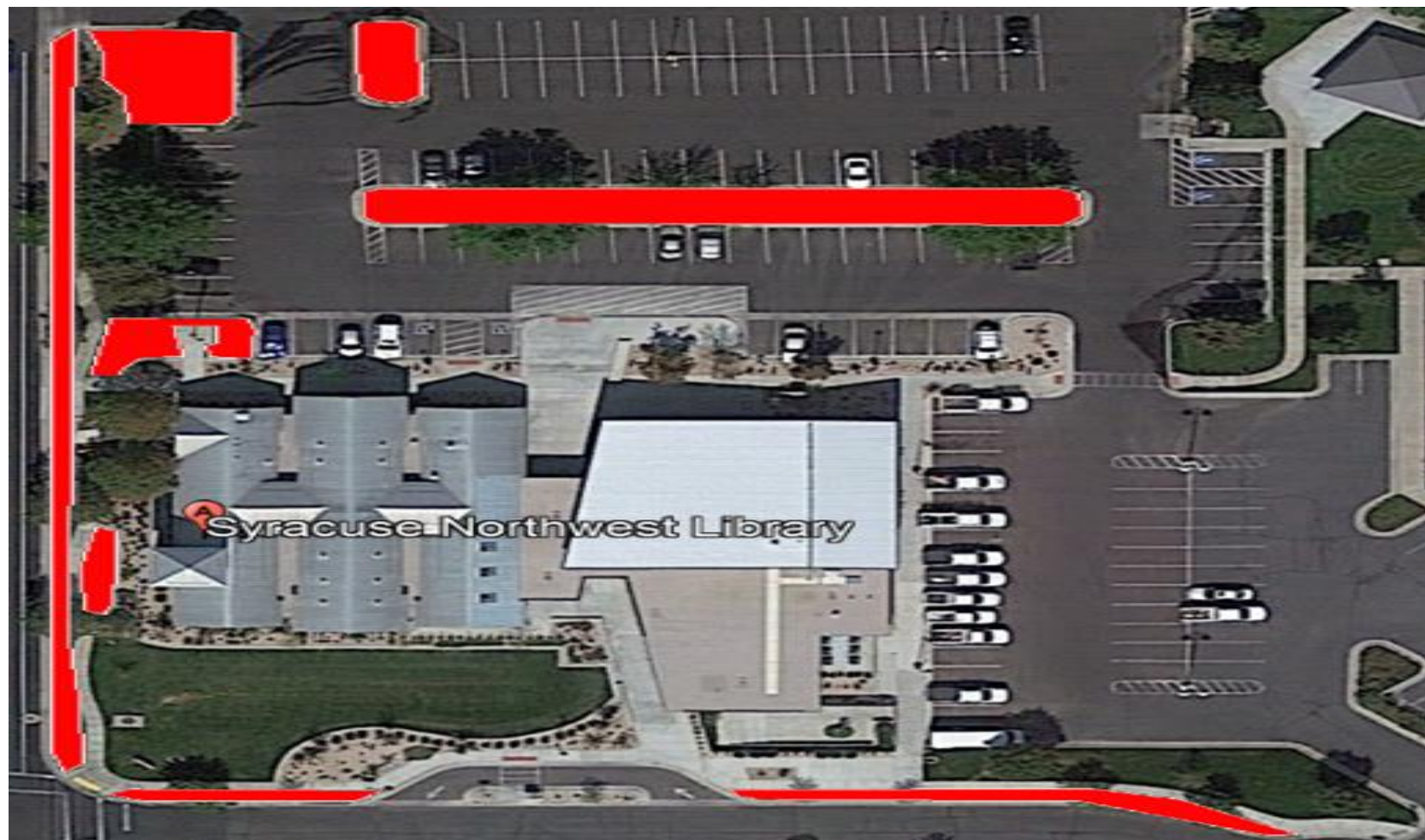
Kaysville Library



Kaysville Library

- 3,306 Total sq. ft. of turf.
- 8-MPR 15 Series 180° @ 1.85 gal/ per min
- 104-MPR 8 Series 180° @ .52 gal/ per min
- **Total of 148,780.8 gallons used per summer.**
- **Plausible water needs for new design = 107,544 gallons**
- **Plausible Net Water Savings = 41,236.8 gallons**
- **Plausible Renovation Costs: \$21,489.00**

Syracuse Library



Syracuse Library

- 8,180 Total sq. ft. of grass
- 30-MPR 12 Series 180° @ 1.30 gal/per min
- 10-MPR 15 Series 180° @ 1.85 gal/per min
- 207-MPR 8 Series 180° @ 0.52 gal/per min
- **356,702.4 gallons of water used per summer**
- **Plausible water needs for new design = 215,630 gallons**
- **Plausible Net Water Savings = 141,072.6 gallons**
- **Plausible Renovation Costs: \$53,170.00**

Central Davis Senior Activity Center



Central Davis Senior Activity Center

- 6,353 Total sq. ft. of turf.
- 36-MPR 15 Series 180° @ 1.85 gal/per min
- 161-MPR 8 Series 180° @ 0.52 gal/per min
- **324,691.2 total gallons used per summer**
- **Plausible water needs for new design = 189,828 gallons**
- **Plausible Net Water Savings = 134,863.2 gallons**
- **Plausible Renovation Costs: \$41,294.50**

Public Works



Public Works

- 6,408 Total sq. ft. of Turf.
- 38-MPR 15 Series 180° @ 1.85 gal/per min
- 5-MPR 15 Series 360° @ 3.70 gal/ per min
- 41-MPR 8 Series 180° @ 0.52 gal/per min
- **237,859 gallons of water used per summer**
- **Plausible water needs for new design = 111,880 gallons**
- **Plausible Net Water Savings = 125,979 gallons**
- **Plausible Renovation Costs: \$41,652.00**

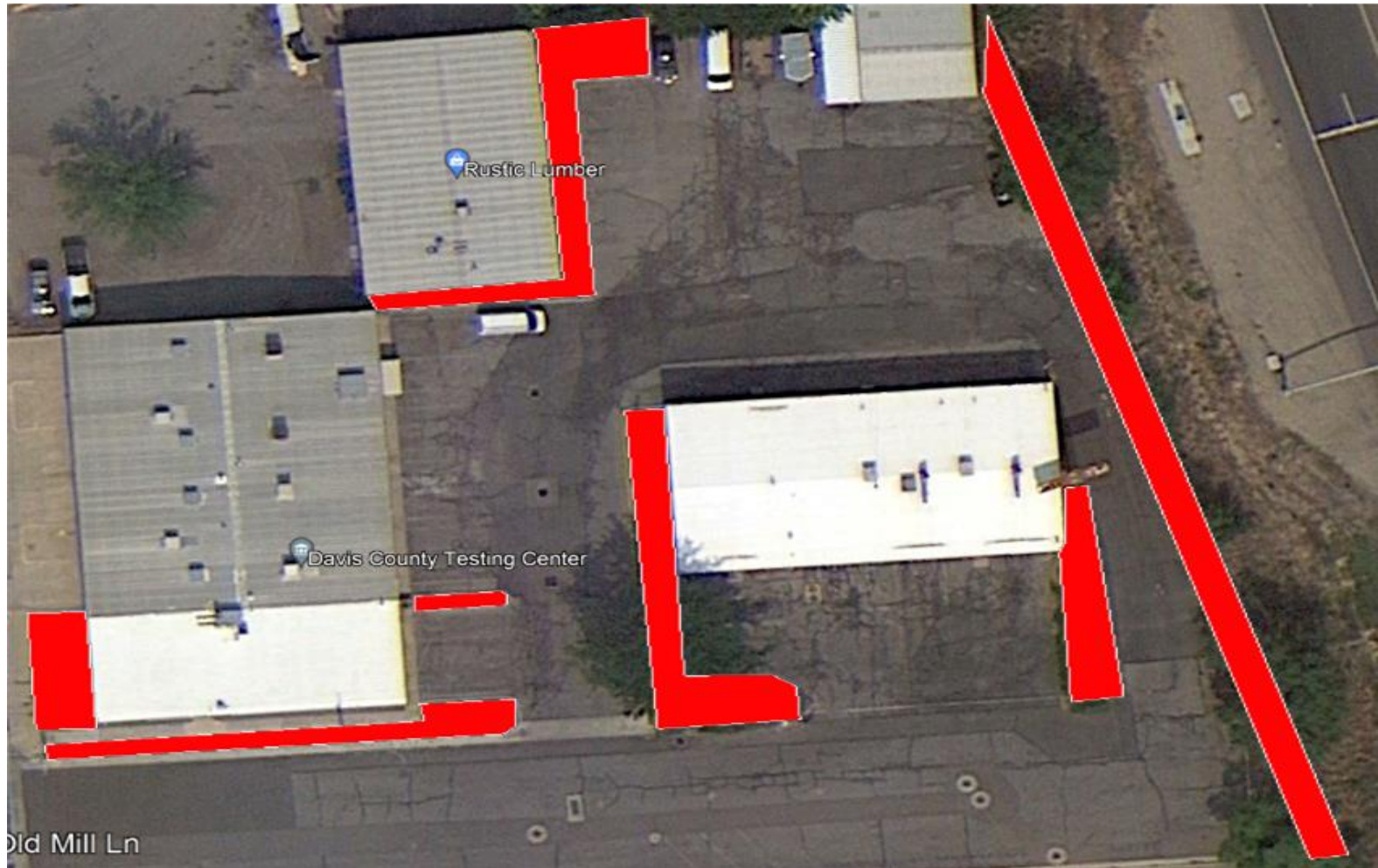
Bountiful Library



Bountiful Library

- 5,900 Total sq. ft. of turf.
- 28-MPR 15 Series 180° @ 1.85 gal/per min
- 100-MPR 8 Series 180 ° @ 0.52 gal/per min
- **224,208 gallons of water used per summer.**
- **Plausible water needs for new design = 93,830 gallons**
- **Plausible Net Water Savings = 130,378 gallons**
- **Plausible Renovation Costs: \$38,350.00**

Tech Center



Tech Center

- 6,735 total sq. ft. of turf.
- 163-MPR 8 Series 180° @ 0.52 gal/per min.
- 11-MPR 15 Series 180° @ 1.85 gal/per min.
- 8-MPR 12 Series 180° @ 1.30 gal/per min.
- **249,501.6 gallons used per summer.**
- **Proposed no new plantings= Net water savings of 249,501.6**
- **Plausible Renovation Costs: \$44,777.50**

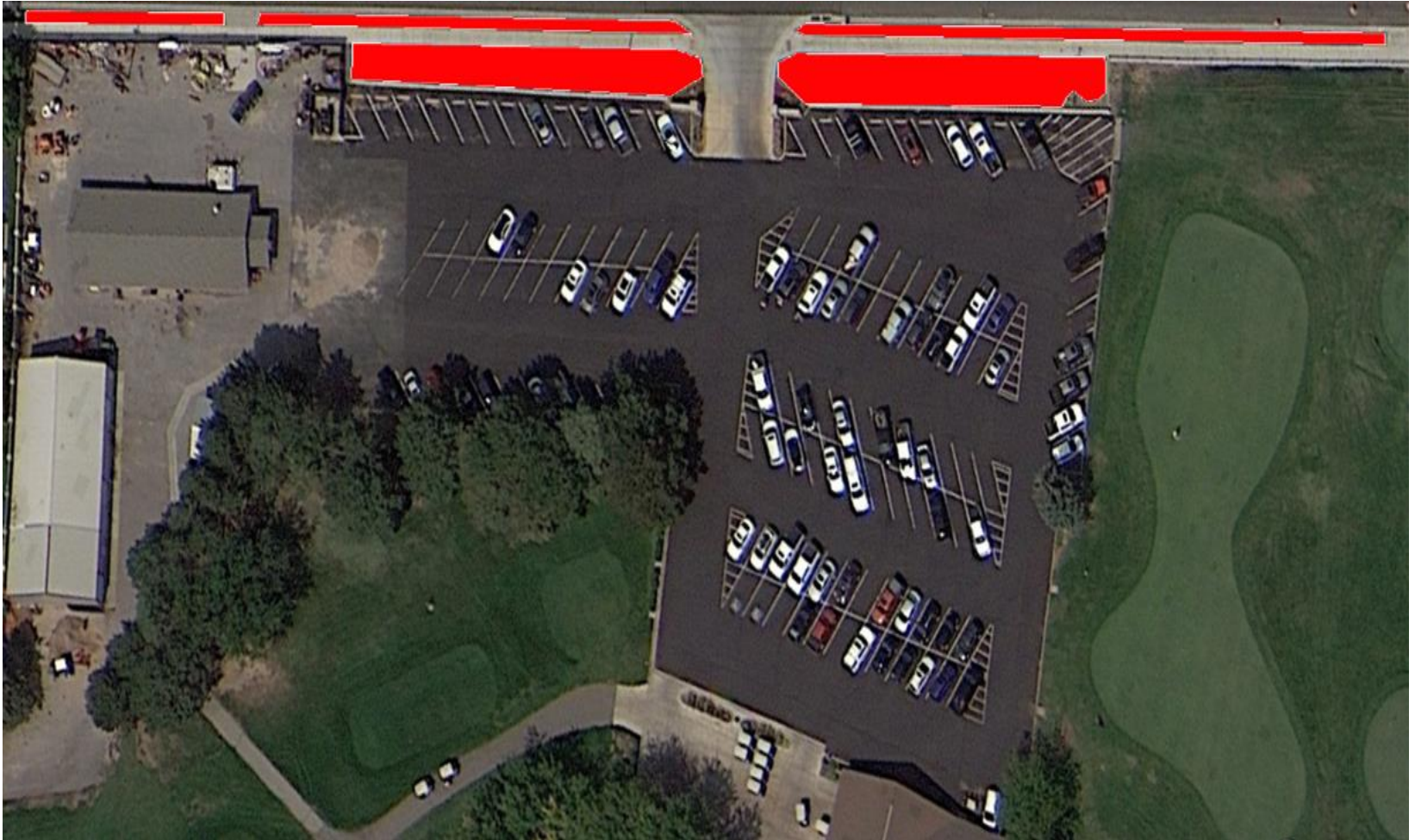
DMV



DMV

- 13,784 Total sq. ft. of turf.
- 61-MPR 8 Series 180° @ 0.52 Gal/per min.
- 27-MPR 12 Series 180° @ 1.30 Gal/per min.
- 60-MPR 15 Series 180° @ 1.85 Gal/per min.
- **381,283.2 gallons used per summer.**
- **Plausible water needs for new design = 180,450 gallons**
- **Plausible Net Water Savings = 200,833.2 gallons**
- **Plausible Renovation Costs: \$89,596.00**

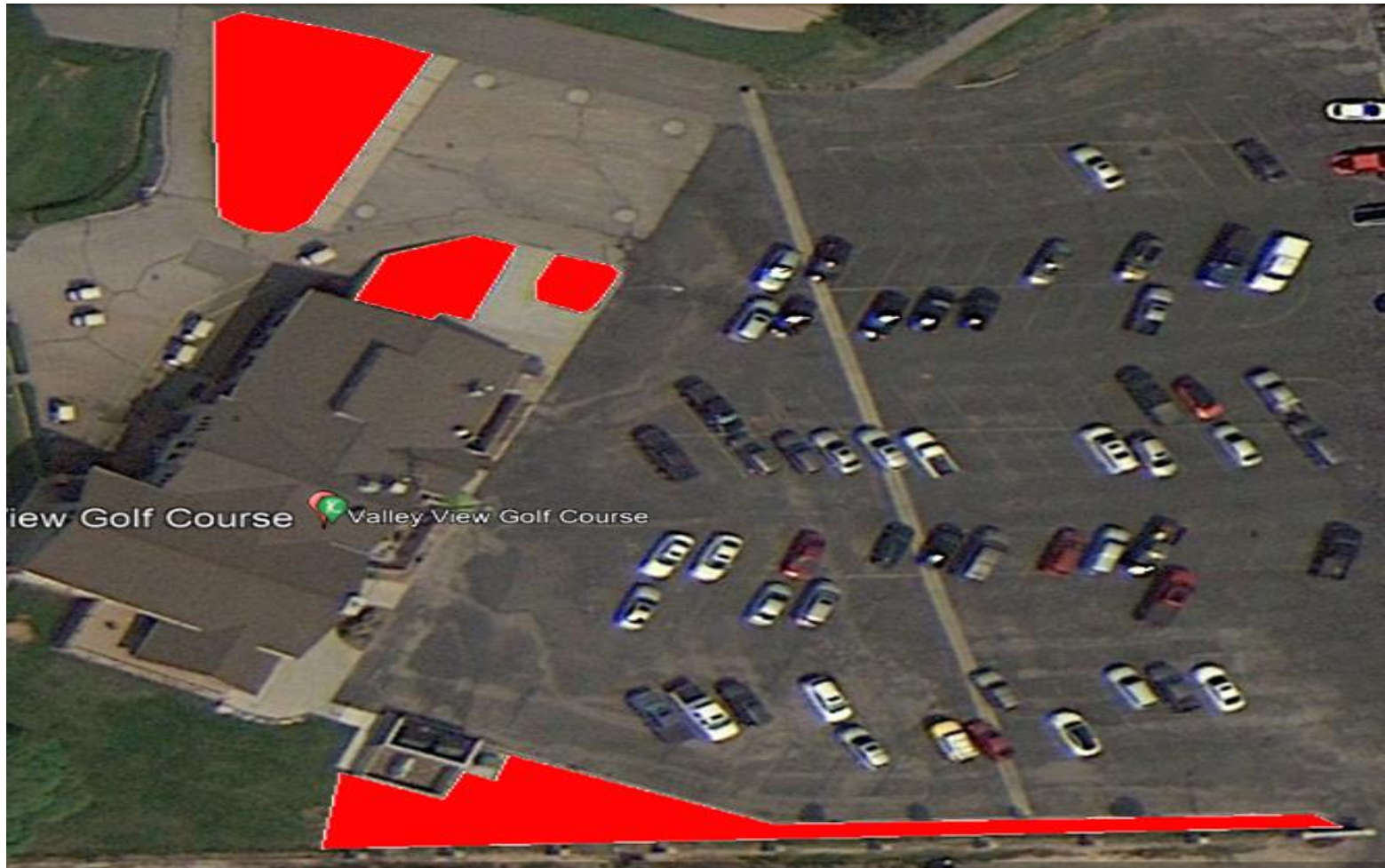
Davis Park Golf Course



Davis Park Golf Course

- 8,288 total sq. ft. of turf.
- 169-MPR 8 Series 180° @ 0.52 gal/per min.
- 60-MPR 12 Series 180° @ 1.30 gal/per min.
- **358,300.8 gallons used per summer.**
- **Plausible water needs for new design = 187,660 gallons**
- **Plausible Net Water Savings = 170,640.8 gallons**
- **Plausible Renovation Costs: \$53,872.00**

Valley View Golf Course



Valley View Golf Course

- 6,114 total sq. ft. of turf.
- 90-MPR 8 Series 180° @ 0.52 gal/per min.
- 9-MPR 12 Series 180° @ 1.30 gal/per min.
- 15-MPR 15 Series 180° @ 1.85 gal/per min.
- **186,300 gallons used per summer.**
- **Plausible water needs for new design = 91,120 gallons**
- **Plausible Net Water Savings = 95,180 gallons**
- **Plausible Renovation Costs: \$39,741.00**

Season Facility Totals

<u>Facilities</u>	<u>Totals</u>
Administration Building	621,600
Health Department	1,726,458
Layton Library	4,083,580
Centerville Library	690,757
Kaysville Library	285,920
Syracuse Library	603,425
Central Davis Senior Activity Center	631,800
Public Works	391,894
Bountiful Library	224,208
Tech Center	249,501
DMV	381,283
Davis Park Golf Course	358,300
Valley View Golf Course	186,300
Total Gallons Used	10,435,026

*Numbers pulled from Baseline Software and Projections

Water Totals

- 10,435,026 gallons over all facilities watering areas used.
- 4,314,988.6 gallons of water used in “non functional turf areas annually.
- 2,648,006.6 gallons Plausible net water savings.
- 50% or more water savings in Turf vs Xeriscaping areas.

- 25% or more in potential water savings in over all facilities watering from last year results.

2 Year- 5,296,013.2 gallons saved

5 Year- 13,240,033 gallons saved

10 Year- 26,480,066 gallons saved

20 year- 52,960,132 gallons saved

Total Plausible Project Costs

<u>Facilities</u>	<u>Costs</u>
Administration Building	\$19,272.50
Health Department	\$68,107.00
Layton Library	\$77,275.25
Centerville Library	\$25,467.00
Kaysville Library	\$21,489.00
Syracuse Library	\$53,170.00
Central Davis Senior Activity Center	\$41,294.50
Public Works	\$41,652.00
Bountiful Library	\$38,350.00
Tech Center	\$44,777.50
DMV	\$89,596.00
Davis Park Golf Course	\$53,872.00
Valley View Golf Course	\$39,741.00
Design cost if needed	\$45,000.00
Total Projected Costs	\$659,063.75

Comparison

- 267 ft. (90 yards) in length X 50 ft. (16.5 yards) width X 10 feet in height. = 1 million gallons of water.
- Olympic pool holds 660,000 gallons of water, which is just under 16 pools for our total water usage.

Xeriscape Examples









22

NO
LEFT TURN
ON RED



Drip Irrigation



(Figure 3: Xeric
scape
Design
, 2018)



References:

- Rainbird.com. (2021). Spray Nozzles MPR Nozzles. Retrieved from https://www.rainbird.com/sites/default/files/media/documents/2020-09/mpr-spray-nozzle-performance-charts_1.pdf
- Xeriscape Design, LC. (2018). Drip Irrigation. Retrieved from <https://www.xeriscapedesign.com/project-gallery/drip-irrigation>
- All site images were used with Google Earth.

Davis County Facilities
Water Savings Estimate
Dec. 2021

These calculations are made with the following assumptions:

- Irrigation year from May 1st to September 30th (21 weeks)
- Average rain year for Davis County
- Average temperatures for Davis County (1 May through 30 September)
- Drip system irrigation
- No turf in park strip or planting areas
- Using monthly average PAN evaporation rates for Davis County
- Trees planted on 30' centers
- Shrubs planted on 6' centers
- Open spaces occasionally between shrubs and tree
- 2" mulch layer on all soil surfaces
- All calculations are assuming the trees are mature (30 years). Water savings would be much greater in years 1 through 15
- Water calculations are for tree and shrubs in a maximum thrive condition. Less water would be used in a survival condition

For simplicity reasons, one shrub cultivar (*Spiraea nipponica*) and one tree species (*Acer campestre*) are used. Other trees and shrubs may affect water usage.

Tree:

Hedge Maple (*Acer campestre*)

Height: 30'

Spread: 30'

Canopy area = 700 sq. ft.

Shrub:

Snowmound Spirea (*Spiraea nipponica*)

Height: 4'

Spread: 6'

Canopy area = 30 sq. ft.

Assumptions:

Formula Used: ET (evapotranspiration rate using PAN) X canopy area (sq. ft.) X 0.8 (PAN comparison variable to cool season grasses) X 0.623 (convert inches to gallons).

Calculations:

Hedge Maple

	PAN (monthly)	Gallons per month per plant*
May	7.3	2,547
June	6.4	2,233
July	9.3	3,245
Aug	8.6	3,001
Sept	4.6	1,604
		12,630

TOTAL

Snowmound Spirea

May	7.3	109
June	6.4	96
July	9.3	139
Aug	8.6	129
Sept	4.6	69
		542

TOTAL

* All numbers rounded up.

Location	Open space (linear feet)	Trees	Total water use per season (#trees X 12,630)	Shrubs	Total water use per season (#shrubs X 542)	Total water usage (Gallons per season)
Davis County Admin	60	7	88,410	15	8,130	96,540
Health Dept	110	15	189,450	40	21,680	211,130
Layton Library	85	20	252,600	40	21,680	274,280
Centerville Library	40	7	88,410	15	8,130	96,540
Kaysville Library	40	8	101,040	12	6,504	107,544
Syracuse Library	80	16	202,080	25	13,550	215,630
Senior Center	65	14	176,820	24	13,008	189,828
Public Works	40	8	101,040	20	10,840	111,880

Bountiful Library	45	7	88,410	10	5,420	93,830
Tech Center	80	0	0	0	0	0
DMV	60	13	164,190	30	16,260	180,450
Davis Park Golf	65	14	176,820	20	10,840	187,660
Valley View	35	7	88,410	5	2,710	91,120
TOTALS	805	136	1,528,230	256	138,752	1,666,982

* All numbers rounded up.

